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PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

A Method of Producing a White-Firing Kaolinitic Clay

We, ENGLISH CLAYS LOVERING POCHIN & COMPANY LIMITED, a British Company, of 14, High Cross Street, St. Austell, Cornwall, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of producing a white-firing, kaolinitic clay suitable for use in the manufacture of ceramic articles.

In the manufacture of ceramic articles one limitation placed upon the ceramist in the necessity of his working with naturally occurring raw materials. These raw materials normally possess a narrow range of properties, and if in the preliminary processing of the raw material one property is improved, some other property is often spoilt, so that in the preliminary processing a compromise has to be reached.

One of the principal raw materials employed in the manufacture of ceramic articles is kaolin (china clay), which is extracted from the ground. The china clays do not consist of pure kaolinite and often contain appreciable quatities of other minerals such as tourmaline, mica, felspar and quartz, (which, in their natural states are normally associated with small amounts of iron), as well as various ferruginous substances. It is usually desired that the clay should fire to a white colour, but the presence of iron-containing impurities causes specking or poor colour in the fired article. In order to reduce the effect of specking or poor colour in the ceramic article, many clays are refined to some extent before they are incorporated in the mixture from which the ceramic article is to be made. Most of the impurities exist in the coarser fractions of the clay (i.e. 5+microns) and because of the difficulty of applying normal mineral separation techniques in a substance of this particle size range, the clays are refined merely by particle size separation, i.e., the coarse fractions are removed and discarded. Among the main disadvantages of this process are (a) a finer clay is produced which has different physical properties from the natural clay, i.e. it may be more difficult to filter or to use in a casting process; and (b) the useful alkali-bearing mineral content of the clay is often concentrated in the coarser fractions and hence if the coarse fractions are removed the alkali content of the clay will be reduced, which is not always desirable.

A process is also known to subject clay slurries to relatively mild magnetic separation treatment to remove foreign or tramp particles with which the clay may have become contaminated during manufacture or transport.

It is an object of the present invention to remove selectively from kaolinitic clay the paramagnetic mineral impurities which are the cause of specking and poor fired colour, without removing the whole of the coarse fraction from the clay. Should the particles of minerals other than kaolinite present in the clay not contain iron, then they will not be wholly removed. However, such iron-free minerals do not detract from the fired colour obtained.

Accordingly, the present invention provides a method of producing a white-firing, kaolinitic clay, which comprises forming a slurry of kaolinitic clay and subjecting the slurry to the action of a non-homogeneous magnetic field having an average strength of at least 10,000 gauss, and preferably at least 15,000 gauss, to separate paramagnetic particles therefrom.

The method can be carried out by employing a high intensity wet magnetic separator, i.e. a separator capable of producing a field strength of at least 10,000 gauss, and a preferred separator is described in British Patent Specification No. 768,451. The term "wet magnetic separator" means that the clay particles, i.e. the kaolin and paramag-

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netic mineral impurities, are passed through the separator suspended in a current of water. It has thus been found that if a raw kaolin, consisting substantially of kaolinite but containing other minerals and produced from a kaolinised granite by the normal hydraulic method of mining, is comminuted to produce a clay which is formed into a slurry and passed through a high intensity wet magnetic separator, the paramagnetic particles are separated therefrom and the resulting clay is of greatly improved firing colour and exhibits much reduced specking, but is, nevertheless, of substantially similar particle size, alkali content and general physical properties to the raw feed clay. The rest results have been obtained for clays, the particles of which are from 5 to 75 microns in size. For clays containing particles outside this range the effectiveness of the process becomes markedly less. It is difficult to obtain a reduction in specking for a clay of particle size appreciably coarser than 75 microns and it is not feasible to effect much improvement in the general fired colour for a clay of particle size appreciably finer than 5 microns, since such clays usually possess quite good fired colour.

It is possible to pass the clay slurry through the magnetic separator more than once to effect successive removals of paramagnetic particles and achieve a slightly better result, though a much smaller improvement is achieved on the second and any subsequent pass.

Obviously, when the clay passed through the separator consists of some particles within the specified size range and some particles outside this range, the total benefit to the clay will be reduced, since less actual benefit is obtained in respect of the particles outside the given range.

The flow rate employed in the separator will depend on the capacity of the separator employed. It is possible to carry out a stationary separation, but this is not normally feasible for economic reasons.

Slurry concentrations are not critical and concentrations up to 30% solids content and more, may be employed. Preferred concentrations are from 20 to 25% solids content.

In order to illustrate the improvement obtained on firing clay treated in accordance with the present invention, a comparison will now be given in the following Table between untreated coarse clay (A), coarse clay refined by the conventional method described above (B), and coarse clay treated in accordance with this invention (C). The clay (B) was refined by removal of the coarse fractions to such a degree as to give the same fired colour as the clay (C) treated in accordance with this invention.

TABLE

	A	B	C
Percentage having particle size above 75 microns.	trace	trace	trace
Percentage having particle size below 5 microns.	12	50	11
Fired colour at 1180°C. (measured as reflectance of 504 m.mic. blue light).	65	81	81
Degree of specking	considerable	very little	very little
Alkali Metal content (%): K_2O	3.5	2.0	3.3
Na_2O	0.26	0.15	0.18
Casting rate (mm^2/min. at 20°C).	30	5	30

In order to determine the casting rate, a high solids content, deflocculated suspension of the clay particles in water was prepared. When this slip is poured into a Plaster of Paris mould water is absorbed by the plaster and a firm layer builds upon the walls of the mould. The rate, in mm. squared/min, at which this layer is deposited, is termed the "casting rate."

It can be seen that with the untreated clay a poor fired colour and a high degree of specking are obtained, although the casting rate is satisfactory; while with the conventionally treated clay, although a good fired colour is obtained and very little specking occurs, the content of K_2O and Na_2O are

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considerably reduced and a poor casting rate results. In contrast, the clay treated in accordance with the present invention gives good results for firing colour and specking degree, while the alkali metal content is not unduly reduced and the casting rate is satisfactory.

It can be seen therefore that the production of a coarse white-firing clay in accordance with the invention makes possible the production of a range of white-firing clays of varying particle size and alkali content by blending the coarse clay treated by the method of the invention with other white-firing clays refined in the normal manner.

WHAT WE CLAIM IS:—

1. A method of producing a white-firing kaolinitic clay, which comprises forming a slurry of kaolinitic clay and subjecting the slurry to the action of a non-homogeneous magnetic field having an average strength of at least 10,000 gauss to separate paramagnetic particles therefrom.

2. A method according to Claim 1, wherein the kaolinitic clay is subjected to the action of a magnetic field by means of a high intensity wet magnetic separator.

3. A method according to Claim 1 or 2, wherein the slurry is formed from clay having a particle size of from 5 to 75 microns.

4. A method according to any preceding claim, wherein the slurry is subjected more than once to the action of the magnetic field to effect successive removals of ferruginous particles.

5. A method according to any preceding claim, wherein the field strength employed is at least 15,000 gauss.

6. A method according to Claim 1 of producing a white-firing, kaolinitic clay, substantially as hereinbefore described.

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